

# BEAUFORT SEA

## SUMMER CONDITIONS

### LEGEND

MINIMUM BIRD MIGRATION CORRIDOR

— • — INSHORE SALT WATER INFLUENCE

(Scale 1:50,000) miles  
0 5 10  
kilometers  
0 5 10 15  
— — — contours in feet

PRODUCED BY ADF&G AND CHPP

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**Marine Fish:** Fourhorn sculpin (*Myoxocephalus quadricornis*), arctic flounder (*Lionetta glacialis*), arctic cod (*Boreogadus saida*) and pacific herring (*Clupea harengus*) live in saline water although some may utilize brackish or freshwater during the ice-free months. In summer these fish frequent the near-shore area feeding on amphipods, mysids, isopods, coelenterates, and chaetognaths. Fourhorn sculpin utilize the nearshore environment for spawning and rearing young. Arctic char feed on young arctic cod (Ward & Craig, 1974).

**Whales:** Both the bowhead and the beluga whales are commonly found in the Beaufort Sea. Coming from southern waters, they migrate easterly along the Beaufort Sea coast as soon as leads in the ice will allow. Beluga whales are believed to feed on nektonic organisms, mainly squid and arctic cod (*Boreogadus saida*) which is commonly eaten in other parts of the arctic. Beluga or white whales calf in the relatively warm waters of river estuaries on the Beaufort Sea coast. Bowhead whales, more abundant in the Alaskan portion of the Beaufort than further east, feed on copepods, amphipods, and euphausiids. (Sergeant and Hoek, 1974).

**Walrus/Bearded Seal:** Pacific walrus (*Odobenus rosmarus*) and bearded seal (*Erigonathus barbatus*) summer ranges border peripherally on this area. In summer Pacific walrus follow the retreating pack ice moving south with the ice in the fall. Walrus feed on benthic fauna, mainly clams, on the Arctic Continental Shelf. Bearded seals occur in low densities along the southern edge of the seasonal ice. Adults are associated with ice, but young seals may remain in ice-free areas including bays and estuaries. Bearded seals feed on crabs, shrimp, clams, and amphipods (State of Alaska Dept. of Fish and Game, 1973).

**Anadromous Fish:** The anadromous fish of this region, arctic cisco (*Coregonus autumnalis*), least cisco (*Coregonus sardinella*), and arctic char (*Salvelinus alpinus*) are tolerant of both freshwater and saline conditions and undertake a seaward migration one or more times during their life. In summer these fish move from freshwater rivers into the nearshore waters to feed. The arctic and least cisco spawn in the lower reaches of the major rivers. All three species tend to return to the fluvial environment in late summer, although least and arctic cisco may possibly overwinter in marine waters. Food sources in the nearshore environment include insects, crustaceans, and fish. Non-anadromous populations of least cisco and arctic char do exist in freshwater. They feed on gammarids, copepods, and other small organisms. (Craig and McCart, 1975).

**Benthos:** Environmental conditions within the entire nearshore region of the Alaskan Beaufort Sea coast are so constant as to be considered a unit environment; thus, lagoonal conditions within the eastern portion of the Beaufort Sea are very similar to conditions in lagoons further to the west. Because of ice, extreme fluctuations in salinity and low concentrations of dissolved oxygen, these shallow arctic lagoons are subject to more severe physical extremes than are found in the open ocean. The "quiet waters" of this area are much less productive than the offshore benthos. Burrowing and sessile organisms are virtually absent from the lagoons. Pelagic invertebrates, amphipods, mysids, and isopods are prevalent. The low salinity of arctic lagoons in summer (in June and early July water at Nuwagak Point is fresh enough to drink. (William Schmidt, 1970)) results from large volumes of freshwater run-off. Rapid thermal erosion of the coastline supplies a large quantity of detritus to this environment.

The semi-protected benthic environment of Camden Bay is neither subjected to the physical extremes experienced in the lagoons nor is it as exposed as unprotected offshore areas. The faunal community of Camden Bay is similar to that of neighboring lagoons. (George and Artie Magnitite, personal communication) (Crane and Cooney, 1973). The unprotected offshore benthos is free of the physical stresses of the nearshore environment and is more productive than the nearshore and lagoonal environments.

**Seals:** The location of ringed seal (*Pheca hispida*) summer populations will fluctuate east to west and distance offshore each year depending upon ice conditions. Population density is limited by three factors: ice conditions, abundance of food and social structure. The ringed seal population is probably limited by the availability of amphipods and fish in the Beaufort Sea. (John Burns, personal communication).

**Polar Bear:** The extent of polar bear (*Ursus maritimus*) summer distribution correlates with ringed seal distribution. Polar bears stay with the drifting pack ice feeding primarily on ringed seal. Some bearded seal are also eaten. Polar bear populations may be more concentrated in the summer due to a reduction in suitable ice surface area (Jack Lentier, 1972).

**Pelagic Birds:** Non-breeding pelagic gulls, jaegers and murrelets feed on small fish, planktonic and benthic crustaceans and benthic bi-valve molluscs offshore to a depth of 30 fathoms. Breeding red-throated loons also feed offshore on arctic cod. (Pete Connors, personal communication). The extent of ice cover found in this region does not noticeably affect bird use. (Jim Bartonek, personal communication).

**Barrier Islands:** The offshore barrier island (and spit) system of the Beaufort Sea is formed and maintained by long-shore drift. Most of these islands (and spits) are composed of fine gravel or coarse sand and are free of vegetation. Generally speaking, islands and spits in this eastern section are composed of finer sediments than those found to the west. Having a maximum altitude of ten feet and up to several miles in length, these islands are breached by infrequent summer storms. Beach profiles change dramatically during these storms. A system of offshore bars fronts the barrier islands, providing protection from storm and ice erosion. The barrier island system creates a "quiet water" protected lagoon environment in the barrier island - mainland interface. (Joe LaBelle, personal communication).

**Migration Corridor:** The migration corridor extends parallel to the coastline and up to 200 meters offshore of the barrier islands. Within this flyway shorebirds migrate east in spring and west in the fall. The increased extent of ice cover in this region affects feeding habitat and thus use of the migration corridor. Low productivity resulting from the undesirable habitat found in this region also affects use. The shorebirds which do use this path, red phalaropes, dunlin, sandpipers, plovers, turnstones, and sanderlings feed within a few meters of the shoreline. The littoral zone is of crucial importance to shorebirds during migration when wind influenced wave wash determines the type, quantity, and location of available amphipods. Arctic terns and Sabine's gulls also migrate along this corridor. Not as dependent as shorebirds on the littoral zone for food, terns and gulls feed primarily offshore on arctic cod. (Pete Connors, Jim Bartonek, Personal comm.).

**Barrier Island Bird Use:** In as much as environmental conditions of the Beaufort Sea coastal region of Alaska can be considered a unit environment, all species of bird which utilizes the western barrier island system has the potential for occurring in the east as well. The specific islands utilized for nesting in any given year are variable and limited to the availability of suitably protected nesting sites. However, the increased extent of ice cover as well as reduced protection from fox predation (many of the barrier strips are actually spits connected to the mainland) make the islands less favorable nesting habitat. Ducks, loons, gulls, arctic tern, and black guillemot may nest on these islands. These same birds also seek out the protection of barrier islands while molting. They feed either in adjacent lagoons or offshore. (Watson and Divoky, 1974a, 1974b) (Jim Bartonek, personal communication).

**Coastline Bird Use:** Gulls, terns and jaegers feed and nest along coastal beaches (Watson and Divoky 1974). The gulls forage for small surface fish, crustaceans and insects along the coastline. Jaegers feed on small birds and insects along beaches and on lemmings found on the tundra.

**Caribou:** In summer the Porcupine herd, (estimated to number 140,000) of barren ground caribou (*Rangifer tarandus*) ranges calves along the coast between the Canning and the Kongakut rivers. The river valleys of the Kongakut, Canning, Jago, Atchilik, and Sadlerochit are important migration routes into the summer calving ground. (Alaska Dept. of Fish & Game, 1973).

**Microtines:** Optimum brown lemming (*Lemmus alascanus*) habitat is found all along the Beaufort Sea coast as a result of the absence of other competitive microtines and the presence of favorable vegetative habitat. The sedge grass marsh found in this wet tundra region provides food and cover for these lemmings. The brown lemming population of the coast is highly cyclic, increasing until limited by available vegetation, then crashing every three or four years. Lemmings are known to feed on each other, providing both population control and food supply. Lemmings are preyed upon by arctic fox, snowy owl, and jaegers. (See and Hall, 1956). Collared lemmings (*Dicrostonyx greenlandicus*) can be found in the drier, slightly elevated portions of the coastal zone, around Camden Bay, but are generally found less frequently than the brown lemming. The larger ermine (*Mustela erminea*) and the least weasel (*Mustela vison*) occur infrequently in this eastern coastal vicinity in response to peak lemming populations and as an extension of their inland range. The Arctic ground squirrel (*Citellus parryi*) and the several species of voles (*Cricetidae*) also inhabit this region.

**Freshwater Fish:** Grayling (*Thymallus arcticus*), longnose sucker (*Catostomus commersoni*), round whitefish (*Prosopium cylindraceum*), broad whitefish (*Coregonus nasus*), humpback whitefish (*Coregonus dupontensis*), slimy sculpin (*Cottus cognatus*), nine-spine stickleback (*unguitus pungitius*) and burbot (*Lota lota*) have a limited tolerance for saline water but can be found in freshwater lakes, streams, and rivers of this area. In the summer when high run-off causes low salinities in the nearshore area, these species of fish may move into the lagoonal environment. Sources of food include insect adults and larvae, small crustaceans, gastropods, fish and fish eggs. Commonly eaten insects include caddisfly larvae and pupae, chironomid larvae, and mayfly combs (McPhail and Lindsey, 1970). Grayling are caught in the upper reaches of the Bula Bula River in April and May by residence of Barter Island. (Richard Furniss, 1974).

**Backshore:** The dominant feature of backshore topography in this eastern section of the Beaufort is the narrowing coastal plain. Twenty miles wide at the Canning River, it is totally absent at Camden Bay, but widens at the Sadlerochit River to form a strip 10 - 15 miles wide. The flat low lying tundra communities of the coastal plain are characterized by micro-relief, standing water and wetland vegetation. Thaw lake basins, both drained and full and the more prominent drainage systems provide larger relief. Polygon wedges with their associated troughs and ridges and slightly elevated pings supporting moss and lichen communities complete the picture.

However, south of Camden Bay the coastal plain is absent and the Sadlerochit foothills continue right up to the coast. Here, the better drained terrain supports tussock-beath tundra and willow communities, characteristic of drier soil.

Primary physical processes shaping backshore topography are dominated by ice and water. Thermal contraction and expansion, uplift from accumulated around ice and subsidence from the thaw of ground ice as well as erosion by water and ice and mass wasting influence this region.

Winds which usually originate out of the northwest coupled with low pressure have been known to produce tides of up to ten feet, greatly exceeding the two-foot maximum diurnal fluctuation. Saltwater can be driven inshore as much as several miles in low lying areas as evidenced by relic drift lines and brackish tundra ponds. (Hume, 1964; Garter Broad, personal communication)

The extent of saltwater intrusion on the backshore region is poorly documented for this area but has been reported here using relic driftwood lines and chemical data obtained from several brackish nearshore ponds. (Kangas, 1972). Saltwater intrusion during severe storms impacts the two major plant communities found in this region, *Carex* spp. dominant wet sedge meadows and aquatic lake, *Arctophila* spp.

**Avian Habitats:** Favorable waterfowl and shorebird habitat in this eastern portion of the Alaskan coastal plain is scarce compared with coastal regions to the west. Several factors contribute to this change. Between the Canning River and Denarcation Point, the coastal plain is very narrow, and behind Camden Bay it is non-existent. In this region, the land is generally higher in elevation (200-400 ft.) and slopes more rapidly than in the west. For these reasons, sedge grass habitat - optimal for waterfowl and shorebird nesting - is absent and productivity is comparatively low. In addition, ice hugs the shore much closer and more persistently, resulting in greatly reduced open water feeding habitat. (Jim Bartonek, personal communication).

The most favorable nesting and feeding habitat exists on the Kongakut - Atchilik River delta, Sika Point on the Kongakut delta, the lower portions of the Jago and Canning river deltas and the coastal area surrounding Simpson Cove. (William Schmidt, Jim Bartonek, personal communication).

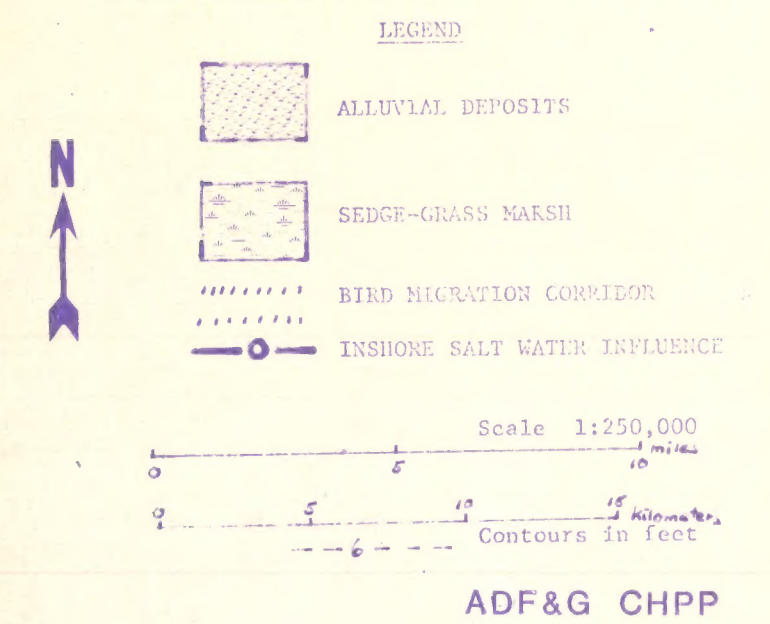
The same species composition normally found further to the west has the potential for nesting and feeding in this area as well.

Canada and white frontal geese probably nest in this area. It is unlikely that brant and snow geese do, however. In addition, species normally found occupying hilly habitats may appear incidentally where foothill habitat meets the coast.

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BEAUFORT SEA  
SUMMER CONDITIONS



Offshore: Non-breeding pelagic gulls, jaegers and murrens feed on small fish, planktonic and benthic crustaceans and benthic bi-valve molluscs offshore to a depth of 30 fathoms. Breeding red-throated loons also feed offshore on arctic cod (Pete Connors, personal communication).

Walrus/Bearded Seal: Pacific walrus (*Odobenus rosmarus*) and bearded seal (*Erignathus barbatus*) summer ranges border peripherally on this area. In summer Pacific walrus follow the retreating pack ice moving south with the ice in the fall. Walrus feed on benthic fauna, mainly clams, on the Arctic continental shelf. Bearded seals occur in low densities along the southern edge of the seasonal ice. Adults are associated with ice, but young seals may remain in ice-free areas including bays and estuaries. Bearded seals feed on crabs, shrimp, clams and amphipods (State of Alaska, Dept. of Fish and Game, 1973).

Polar Bear: The extent of polar bear (*Ursus maritimus*) summer distribution correlates with ringed seal distribution. Polar bears stay with the drifting pack ice feeding primarily on ringed seal. Some bearded seal (*Erignathus barbatus*) are also eaten. Polar bear populations may be more concentrated in the summer due to a reduction in suitable ice surface area (Jack Lonfer, 1972).

Ringed Seal: The location of ringed seals (*Phoca hispida*) summer populations will fluctuate east to west and distance offshore each year depending upon ice conditions. Population density is limited by three factors: ice conditions, abundance of food and social structure. Seals seek smooth flat drifting pack ice where they find the greatest protection from predation. The ringed seal population is probably limited by the availability of amphipods and fish in the Beaufort Sea. Seals are territorial and distribute themselves accordingly throughout favorable habitat areas (John Burns, personal communication).

Barrier Islands: The larger islands provide protected nesting to ducks, loons, gulls, arctic tern and black guillemots from predation primarily by arctic fox. The specific islands utilized for nesting in any given year are variable and limited to the availability of suitably protected nesting sites (i.e. driftwood, crates, abandoned dwellings). It has been reported that one fox on Cross Island destroyed that island's entire eider, nesting effort one summer. The following year, in the absence of fox, nesting resumed (George Divoky, personal communication). These same birds also seek out the protection of the barrier islands while molting. They feed either in the adjacent lagoons or offshore (Watson and Divoky, 1974).

Benthos: Summer conditions within the lagoons are highly variable. The instability of the system is reflected by low diversity of infaunal and paucity of infaunal species. The isopod *Mediomastus californiensis*, the mysid *Mysis oculata*, and the amphipod *Caprellid* *Leptochela* are ubiquitous within the area. Species present must be able to tolerate large fluctuations in salinity and temperature as well as survive intensive ice scouring. Because of this, the more successful organisms are those that are mobile and able to migrate into the lagoonal systems during the ice-free season (Crane and Connors, 1973).

Marine Fish: Fourhorn sculpin (*Myoxocephalus quadricornis*), arctic flounder (*Lioneltochthys alba*), arctic cod (*Boreogadus saida*) and Pacific herring (*Clupea harengus*) live in saline water although some may utilize brackish or freshwater during the ice-free months. In summer these fish frequent the near-shore area feeding on amphipods, mysids, isopods, coelenterates, and chaetognaths. Fourhorn sculpin utilize the nearshore environment for spawning and rearing young. Arctic char feed on young arctic cod (Ward & Craig, 1974).

Coastline: Gulls, terns and jaegers feed and nest along coastal beaches (Watson and Divoky, 1974). The gulls forage for small surface fish, crustaceans and insects along the coastline. Jaegers feed on small birds and insects along beaches and on lemmings found on the tundra.

Alluvial Deposits: Alluvial deposits are of primary importance to white-fronted geese, shorebirds, and gulls for nesting. The white-fronted geese nest on low silt covered islands of the delta where sedge communities are found. The geese feed on *Equisetum* spp. and *Carex* spp. In these sedge communities (Cal Connors, personal communication). Shorebirds favor the mud flat delta regions of the western Colville River delta to that of either the eastern portion of the Colville delta or of the Kuparuk or Sag River deltas which are composed of coarser gravel (Pete Connors, personal communication). Gulls nest on the coarser gravel bars of the deltas. Black-brant geese, shorebirds and gulls utilize the delta bars for resting activities during migration and molt (Kessel, 1958).

Backshore Region: The back-shore region of the coastal zone is influenced primarily by tundra during severe storms. Ignate out of the northwest breeze known to produce tides of up to ten feet, greatly exceeding the two foot maximum water can be driven inshore as denoted by relic drift lines. The zone has been extended in lowland drainage areas and where salt tolerance in the (Hume, 1964; Carter Broad,

shore region of the coastal zone saltwater flooding the lowland tundra, which usually coupled with low pressure have up to ten feet, greatly exceeding the two foot maximum water can be driven inshore as denoted by relic drift lines. The zone has been extended in lowland drainage areas and where salt tolerance in the (Hume, 1964; Carter Broad,

Pingos: Pingos and other slightly elevated portions of tussock-heath tundra are important nesting, feeding and resting sites for jaegers and snowy owls. Jaegers and snowy owls are attracted to these dryer tundra sites because they are favored by lemmings, a primary prey item (Bailey, 1948).

Avian Habitats: The braided streams, tundra ponds and tundra pond water edge habitats found along the coast support intensive avian activity. On the entire coastline, the Colville River delta receives the heaviest bird use. On the tundra ponds and braided streams for shorebirds and waterfowl. edge in general are more heavily river waters (Cal Connors, personal communication); swans, ducks, and at their edges. Some utilize these lacustrine waters and tundra on freshwater plants and animals and shorebirds are catching tundra insects and freshwater organisms. The tundra pond water edge is crucial to ducks, loons, murrens, and shorebirds feeding and nesting where adjacent water bodies can support necessary resting and (for all but the red-throated loon) feeding activities. The day, returning less heavily important to geese and ducks forage (Kessel, 1958).

Freshwater Fish: Grayling (*Thymallus arcticus*), longnose sucker (*Catostomus commersoni*), round whitefish (*Prosopium cylindraceum*), broad whitefish (*Coregonus nasus*), humpback whitefish (*Coregonus clupeaformis*), slimy sculpin (*Cottus cognatus*), nine-spine stickleback (*Pungitius pungitius*), and burbot (*Lota lota*) have a limited tolerance for saline water but can be found in freshwater lakes, streams and rivers of this area. In the summer when high runoff causes low salinities in the nearshore area, these species of fish may move into the lagoonal environment. Sources of food include insect adults and larvae, small crustaceans, gastropods, fish and fish eggs. Commonly eaten insects include caddisfly larvae and pupae, chironomid larvae, and mayfly nymphs (McPhail and Lindsey, 1970).

Arctic Fox: The arctic fox (*Alopex lagopus*) is highly dependant on the coastal lemming population upon which it feeds. The arctic fox population is cyclic, peaking every three or four years according to local lemming cycles. In summer these fox concentrate around prime food sources; bird nesting sites and lemming communities. The arctic fox also benefits from wolf predation on caribou and moose in scavenging for caribou. Fox can be found all along the coast and on some of the larger tundra covered barrier islands although specific barrier island use varies from year to year depending upon availability of food (Arctic Gas Biological Report Series Volume 9, 1974).

Caribou: An estimated five to ten thousand caribou (*Rangifer tarandus*) summer along the coast between the Colville and the Canning Rivers where onshore breezes provide relief from tundra heat. Insect conditions improve the caribou return inland. The coastal caribou population is evenly distributed throughout this region, feeding on lichen, sedge and cotton grass (David Klein, personal communication). Wolves (*Canis lupus*) primarily prey on caribou and can be found following their migration into the region.

Microtines: Optimum brown lemming (*Lemmus alascanensis*) habitat is found all along the Beaufort Sea coast as a result of the absence of other competitive microtines and the presence of favorable vegetative habitat. The sedge-grass marsh found in this wet tundra region provides both food and shelter for these lemmings. The brown lemming population of the coast is highly cyclic, increasing until limited by available vegetation, then crashing every three or four years. Lemmings are preyed upon by arctic fox, snowy owls and jaegers (Ree and Hall, 1956).

Energy Dissipation: The current regime within the lagoons is variable and highly dependent on wind direction. Prevailing northeasterly winds result in a net longshore drift to the west maintaining a series of offshore bars along most of the barrier islands. The extent of thermal erosion of beach sediments and tundra coastline is for the most part the result of wave energy reaching the beach. The offshore bars serve to dissipate some of this energy, particularly the longer period waves associated with storms. Because of the essentially low profile of these islands, it is not unusual for infrequent summer and fall storms to completely wash over the barrier islands and invade the shoreline. Beach profiles change dramatically during these storms. Islands may breach in places and be intensively reshaped (Short, Colman and Wright, 1974). The extent of salt water intrusion on the backshore region is poorly documented for this area but has been approximated here using relic driftwood lines and chemical data obtained from several brackish nearshore ponds (Kangas, 1972).

Migration Corridor: Red phalaropes, dunlin, sandpipers, plovers, turnstones and sanderlings migrate along the coastline in a corridor extending up to 200 meters offshore of the barrier islands. These shorebirds feed between one and two meters from shoreline. The littoral zone is of crucial importance to shorebirds during migration when wind influenced wave wash determines the type, quantity and location of available amphipods. Arctic terns and Sabine's gulls also migrate along this corridor. Not as a dependant as shorebirds on the littoral zone for food, terns and gulls feed primarily offshore in arctic cod (Pete Connors, personal communication).

Coastline Erosion: Rapid thermal and mechanical erosion of the coastline during the summer increases the sediment load along the beaches and may be an important detrital input into the nutrient budget of the nearshore system.

Flaxman I.

Maguire I.

Tigvarik I.

Foggy Island Bay

Howe I.

Prudhoe Bay

Sagayaviktok R.

Kuparuk R.

Shaviovik R.

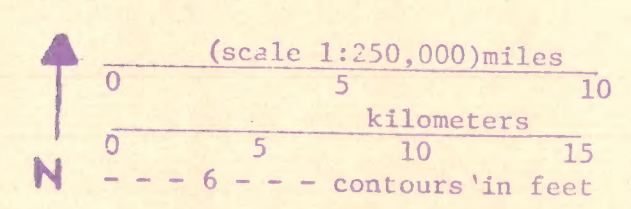
Canning R.



BEAUFORT SEA  
SUMMER CONDITIONS

LEGEND

||||| BIRD MIGRATION CORRIDOR  
-o- INSHORE SALT WATER INFLUENCE



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PREVAILING WIND DIRECTION

Offshore: The offshore environment of the northernmost portion of the Beaufort Sea is influenced by the neighboring Chukchi Sea. At Point Barrow, the dominant northeasterly flow of the Chukchi meets the counterclockwise gyre of the Beaufort Sea. Freshwater inflow from the Meade, Topovuk and Chip Rivers influences the offshore regime east of Point Barrow and combines with a low rate of evaporation to create a low saline environment. An abundance of jellyfish, ctenophores, chaetognaths, mysids, euphausiids, pteropods and copepods occur in the offshore region. The three types of bottom sediment found in this region occur in zones running parallel to the coast. Continuous with the beach out to a depth of 10 to 20 feet is a layer of gravel. From this point out to approximately 100 feet lies blue mud. Beyond this to the edge of the shelf is rubble. The rubble is composed of coarse gravel, some boulders and shell. Epibenthic organisms including bryozoans, sea anemones, sea cucumbers, sea urchins, sponges and barnacles are found there. The mud zone contains much less fauna. Extremely abundant foraminifera attached to hydroids, bryozoans, sponges, barnacles, shells, worm tubes, clitons and tunicates, and amphipods, hermit crabs, crabs and clams inhabit the mud zone (MacGinitie, 1955).

Pelagic Birds: Non-breeding pelagic gulls, jaegers and murre feed on small fish, planktonic and benthic crustaceans and benthic bivalve molluscs off-shore to a depth of 30 fathoms. Breeding red-throated loons also feed off-shore on arctic cod (Pete Gomers, personal communication).

Marine Fish: Fourhorn sculpin (*Moxocephalus quadricornis*), arctic flounder (*Liopsetta glacialis*), arctic cod (*Boreogadus saida*) and pacific herring (*Clupea harengus*) live in saline water although some may utilize brackish or freshwater during the ice-free months. In summer these fish frequent the near-shore area feeding on amphipods, mysids, isopods, coelenterates, and chaetognaths. Fourhorn sculpin utilize the nearshore environment for spawning and rearing young. Arctic char feed on young arctic cod (Ward & Craig, 1974).

Barrier Island System: The offshore barrier island system of the Beaufort Sea is formed and maintained by longshore drift. The majority of these islands is composed of fine gravel or coarse sand and is free of vegetation. Cooper Island is composed of coarse gravel. Having a maximum altitude of four feet and up to several miles in length, these islands are breached by frequent summer storms. Beach profiles change dramatically during these storms. A system of offshore bars fronts the barrier islands, providing protection from storm and ice erosion. The barrier island system creates a "quiet water" protected lagoon environment in the barrier island-mainland interface. (Joe Labelle, personal communication).

Seals: The location of ringed seal (*Phoca hispida*) summer populations will fluctuate east to west and distance offshore each year depending upon ice conditions. Population density is limited by three factors: ice conditions, abundance of food and social structure. The ringed seal population is probably limited by the availability of amphipods and fish in the Beaufort Sea. Bearded seals (*Ergasilus barbatus*) also stay with the ice in summer and feed on epibenthic invertebrates. The (ice free) coastal area is occupied by harbor seals (*Phoca vitulina*). Harbor seals are not evenly distributed, but instead group in estuaries and bays where schools of fish provide optimum feeding habitat. These seals also travel up the larger rivers in search of fish. The population of harbor seals is estimated at between 1,500 and 2,000 (John Burns, personal communication).

Benthos: Summer conditions within the Elson Lagoon/Dease Inlet/Admiralty Bay protected region are very similar to conditions in lagoons further to the east. The "quiet waters" of this area are quite shallow and much less productive than the offshore benthos. Because of the sticky clay bottom found throughout this protected area, burrowing and sessile organisms are virtually absent from the lagoon. Pelagic invertebrates, amphipods, mysids and isopods are found in abundance, however. The low salinity of the Elson Lagoon complex (resulting from large volumes of freshwater run-off) is not significantly different than that found outside of the barrier islands. Rapid thermal erosion of the coastline supplies a large quantity of detritus to this environment. Elutkak Pass is exceptional because of the strong current which runs out of it. Within the channel is found a rocky bottom where sessile organisms thrive on the bare rock. Why this channel and no other maintains a strong current is unknown (George and Nettie MacGinitie, personal communication).

Migration Corridor: Red phalaropes, dunlin, sandpipers, plovers, turnstones and sanderlings migrate along the coastline in a corridor extending up to 200 meters offshore of the barrier islands. These shorebirds feed between one and two meters from shoreline. The littoral zone is of crucial importance to shorebirds during migration when wind influenced wave wash determines the type, quantity and location of available amphipods. Arctic terns and Sabine's gulls also migrate along this corridor. Not as dependant as shorebirds on the littoral zone for food, terns and gulls feed primarily offshore on arctic cod (Pete Gomers, personal communication).

Coastline Bird Use: Gulls, terns and jaegers feed and nest along coastal beaches (Watson and Divoky 1974). The gulls forage for small surface fish, crustaceans and insects along the coastline. Jaegers feed on small birds and insects along beaches and on lemmings found on the tundra.

Coastal Dynamics: Rapid thermal and mechanical erosion of the coastline in summer (resulting on an average of 1.3 meters per year (Lavelle, 1972)) increases the sediment load along the beaches providing important detrital input into the nutrient budget of the nearshore system. Coastal slumping provides sediment for barrier island and beach maintenance. Out-wash banks up to approximately eight meters in height characterize protected portions of the coastline while exposed sections support gravel beaches up to 35 meters wide. Barrow Spit is maintained by longshore drift in the Chukchi Sea. The barrier islands are a product of westward sediment transport in the Beaufort Sea. Tundra covered islands at bay mouths are coastal remnants (Joe Labelle, personal communication).

Avian Habitats: The braided streams, tundra lakes and ponds and tundra pond water edge habitats found along the coast support intensive avian activity. Because of its ideal wetland environment the backshore region located between Teshekpuk Lake and the coastline is the most intensively used waterfowl nesting habitat on the entire Alaskan coast of the Beaufort Sea. The Inaru, Meade and Ikpiuk River deltas are also optimum waterfowl nesting habitat. The coastal habitat of Pet 4 supports a larger waterfowl nesting population than the coastal region further to the east. Tundra ponds and their water's edge are more heavily used for feeding than are flowing river waters (Cal Lonsdale, personal communication); swans, ducks and shorebirds feed on these ponds and at their edges. Geese feed on Carux and Puckatilla spp. Ducks utilize both plants (*Grasshopper*, *Crustaceans*) and fairy shrimp, water fleas. Whistling swans are distributed all along the coast on large bodies of water with substantial vegetative cover. Arctic loons feed on invertebrates (Cudatella and Tadpole shrimp, fairy shrimp, water fleas) in deep *Arctophila* ponds while nesting. While nesting, phalaropes are also abundant in this coastal zone, utilizing adult midges and spiders, fairy shrimp and water fleas. The tundra pond water edge is crucial to ducks, loons, swans and shorebirds for nesting. Adjacent water bodies support necessary resting and (for all but the red-throated loon) feeding activities. The red-throated loon night on to feed offshore each day, returning at night to nest and roost in the wet-tundra habitat. Less heavily utilized, the braided streams are nevertheless important to waterfowl for feeding and resting upon. In the streams, geese and swans feed on aquatic vegetation. Ducks forage for snails, insects, fish and aquatic vegetation. Snowy owls are concentrated within two to three miles of the coast. They feed on lemmings and nest on the more elevated dryer pings.

Caribou: An estimated 2,500 to 3,000 resident caribou (*Samifer larangue*) range between the Colville River and Teshekpuk Lake where onshore breezes provide relief from insects. A portion of the Western Arctic herd migrates north to within thirty or forty miles of Pt. Barrow each summer. The caribou feed on lichen, sedge and cotton grass. (David Klein, personal communication). Wolves (*Canis lupus*) prey primarily on caribou and can be found following their migration into the region.

Microtines: Optimum brown lemming (*Lemmus alascensis*) habitat is found all along the Beaufort Sea coast as a result of the absence of other competitive microtines and the presence of favorable vegetative habitat. The sedge grass marsh found in this wet tundra region provides both food and shelter for these lemmings. The brown lemming population of the coast is highly cyclic, increasing until limited by available vegetation, then crashing every three or four years. Lemmings are known to feed on each other, providing both population control and food supply. Lemmings are preyed upon by arctic fox, snowy owls and jaegers. (Joe and Hall, 1956). Collared lemmings (*Dicrostonyx groenlandicus*) can be found in the dryer, slightly elevated portions of the coastal zone but occur much less frequently. The larger lemmings (*Stelea crinita*) and the least weasel (*Mustela vison*) occur infrequently in the vicinity of Pt. Barrow in response to peak lemming populations.

Backshore: The westernmost portion of the very flat low lying backshore region of this section of the coastal zone is characterized by microrelief, standing water and wetland vegetation. The lake basins and the more prominent drainage systems provide larger relief. Bayon wedges with their associated troughs and ridges, slightly elevated pings and stabilized sand dunes complete the picture. A 15 to 20 mile band of land bordering the coast between Atigaru Point and the Meade River and between Teshekpuk Lake and the Kogru River is composed of well-drained, stabilized, vegetated (grasses and some scrub willow) sand dunes.

Primary physical processes shaping backshore topography are dominated by ice and water. Thermal contraction and expansion, uplift from accumulated ground ice and subsidence from the thaw of ground ice as well as erosion by water and ice and mass wasting influence this region. Winds which usually originate out of the northwest coupled with low pressure have been known to produce tides of up to ten feet, greatly exceeding the two foot maximum diurnal fluctuation. Saltwater can be driven inshore as much as three miles as evidenced by relict drift lines and brackish tundra ponds. The zone has been extended in places to account for lowland drainage areas and salt spray effects on the tundra where salt tolerance in the vegetation seems to be marginal. (Hume, 1964; Carter Broad, personal communication).

The extent of saltwater intrusion on the backshore region is poorly documented for this area but has been approximated here using relict driftwood lines and chemical data obtained from several brackish nearshore ponds. (Kouge, 1972). Saltwater intrusion during severe storm impacts the two major plant communities found in this region, Carux spp. dominant wet sedge meadows and aquatic lake *Arctophila* spp. The dryer hummocks and pings maintain a third community of mosses and lichens.

Freshwater Fish: Grayling (*Thymallus arcticus*), longnose sucker (*Catostomus commersoni*), round whitefish (*Prosopium cylindraceum*), broad whitefish (*Coregonus nasus*), humpback whitefish (*Coregonus clupeaformis*), slimy sculpin (*Cottus cognatus*), ninespine stickleback (*Pungitius pungitius*), and burbot (*Lota lota*) have a limited tolerance for saline water but can be found in freshwater lakes, streams and rivers of this area. In the summer when high runoff causes low salinities in the nearshore area, these species of fish may move into the lagoonal environment. Sources of food include insect adults and larvae, small crustaceans, gastropods, fish and fish eggs. Commonly eaten insects include caddisfly larvae and pupae, chironomid larvae, and mayfly nymphs (McPhail and Lindsey, 1970). The Meade, Inaru and Chip rivers are important fisheries for the people of the Barrow area.

Anadromous Fish: The anadromous fish of this region, arctic cisco (*Coregonus autumnalis*), least cisco (*Coregonus sardinella*) and arctic char (*Salvelinus alpinus*) are tolerant of both freshwater and saline conditions and undertake a seaward migration one or more times during their life. In summer these fish move from freshwater rivers into the nearshore waters to feed. The arctic and least cisco spawn in the lower reaches of the major rivers. All three species tend to return to the fluvial environment in late summer although least and arctic cisco may possibly overwinter in marine waters. Food sources in the nearshore environment include insects, crustaceans, and fish. Non-anadromous populations of least cisco and arctic char do exist in freshwater. They feed on gammarids, copepods and other small organisms. (Craig and McCart, 1975). Pink salmon (*Oncorhynchus gorbuscha*), chin salmon (*Oncorhynchus keta*) and chinook salmon (*Oncorhynchus tshawytscha*) as well as candlefish (*Chaileichthys pacificus*) are also found incidentally within the protected waters of Elson Lagoon, Dease Inlet and Admiralty Bay in summer. (Bud Heinrichs, personal communication).

Teshekpuk: Teshekpuk Lake is unaffected by saltwater influence. Lake trout (*Salvelinus namaycush*), broad whitefish (*Coregonus nasus*), round whitefish (*Prosopium cylindraceum*), humpback whitefish (*Coregonus clupeaformis*), blackfish (*Gadus pectoralis*), burbot (*Lota lota*), arctic cisco (*Coregonus autumnalis*), least cisco (*Coregonus sardinella*), longnose sucker (*Catostomus commersoni*), ninespine stickleback (*Pungitius pungitius*), grayling (*Thymallus arcticus*), northern pike (*Esox lucius*) and coho salmon (*Oncorhynchus kisutch*) have all been caught in Teshekpuk. Arctic char (*Salvelinus alpinus*) is assumed present. Some or all of these fish can be found in other good-sized coastal lakes. (Bud Heinrichs, personal communication).

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